

CLAIMS

1. A liquid crystal display device comprising:
 - a pair of substrates;
 - 5 a liquid crystal interposed between the pair of substrates;
 - a thin film transistor over one of the pair of substrates; and
 - a pixel electrode connected to the thin film transistor,
 - wherein the thin film transistor comprises:
 - a gate electrode formed over the substrate by fusing conductive nanoparticles,
 - 10 a layer including at least one of silicon nitride and silicon oxynitride formed on and in direct contact with the gate electrode,
 - a gate insulating layer at least containing a layer comprising silicon oxide over the layer, and
 - a semiconductor layer over the gate insulating layer.
- 15 2. A liquid crystal display device comprising:
 - a pair of substrates;
 - a liquid crystal interposed between the pair of substrates;
 - a thin film transistor over one of the pair of substrates; and
 - 20 a pixel electrode connected to the thin film transistor,
 - wherein the thin film transistor comprises:
 - a gate electrode formed over the substrate by fusing conductive nanoparticles,
 - a first layer including at least one of silicon nitride and silicon oxynitride formed on and in direct contact with the gate electrode,
 - 25 a gate insulating layer at least containing a silicon oxide layer over the first layer, and
 - a semiconductor layer over the gate insulating layer;
 - a wiring connected to at least one of a source and a drain; and
 - a second layer including at least one of silicon nitride and silicon oxynitride
 - 30 formed to be on and in direct contact with the wiring,

wherein the wiring formed by fusing conductive nanoparticles.

3. A liquid crystal display device comprising:

a pair of substrates;

5 a liquid crystal interposed between the pair of substrates;

a first thin film transistor over one of the pair of substrates;

a pixel electrode connected to the thin film transistor;

a driver circuit constructed by a second thin film transistor which comprises the same layer structure of the first thin film transistor; and

10 a wiring extending from the driver circuit and connected to a gate electrode of the first thin film transistor,

wherein the first thin film transistor comprises:

the gate electrode formed over the substrate by fusing conductive nanoparticles,

15 a layer including at least one of silicon nitride and silicon oxynitride formed on and in direct contact with the gate electrode,

a gate insulating layer at least containing a layer comprising silicon oxide over the layer, and

a semiconductor layer over the gate insulating layer.

20 4. A liquid crystal display device comprising:

a pair of substrates;

a liquid crystal interposed between the pair of substrates;

a first thin film transistor over one of the pair of substrates;

a pixel electrode connected to the thin film transistor;

25 a driver circuit constructed by a second thin film transistor which comprises the same layer structure of the first thin film transistor; and

a wiring extending from the driver circuit and connected to a gate electrode of the first thin film transistor,

wherein the thin film transistor comprises:

30 a gate electrode formed over the substrate by fusing conductive nanoparticles,

a first layer including at least one of silicon nitride and silicon oxynitride formed on and in direct contact with the gate electrode,

a gate insulating layer at least containing a silicon oxide layer over the first layer, and

5 a semiconductor layer over the gate insulating layer;

a wiring connected to at least one of a source and a drain; and

a second layer including at least one of silicon nitride and silicon oxynitride formed on and in direct contact with the wiring,

wherein the wiring formed by fusing conductive nanoparticles.

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5. The liquid crystal display device according to any one of claims 1 to 4, wherein the conductive nanoparticles comprise Ag.

6. The liquid crystal display device according to claim 2 or 4,

15 wherein the semiconductor layer comprises at least one of hydrogen and halogen; and

wherein the semiconductor layer is a semi-amorphous semiconductor having a crystal structure.

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7. The liquid crystal display device according to claim 2 or 4, wherein the driver circuit comprises only an n-channel type thin film transistor.

8. The liquid crystal display device according to claim 1 or 2,

25 wherein the thin film transistor comprises the semiconductor layer including hydrogen and halogen and which is a semiconductor having a crystal structure,

wherein the thin film transistor is capable of being operated in electric field effect mobility of from $1 \text{ cm}^2/\text{V}\cdot\text{sec}$ to $15 \text{ cm}^2/\text{V}\cdot\text{sec}$.

9. The liquid crystal display device according to claim 3 or 4,

30 wherein the first thin film transistor and the second thin film transistor comprise

the semiconductor layer including hydrogen and halogen and which is a semiconductor having a crystal structure,

wherein the first thin film transistor and the second thin film transistor are capable of being operated in electric field effect mobility of from 1 cm²/V·sec to 15 cm²/V·sec.

10. A liquid crystal television receiver comprising the liquid crystal display device according to any one of claims 1 to 4.

10 11. A method for manufacturing a liquid crystal display device comprising the steps of:

forming a gate electrode over a substrate having an insulating surface with a droplet discharge method;

15 laminating a gate insulating layer, a semiconductor layer, and an insulating layer over the gate electrode;

forming a first mask in a position overlapping with the gate electrode with a droplet discharge method;

forming a channel protective layer by etching the insulating layer by using the first mask;

20 forming a semiconductor layer containing one conductivity type impurity;

forming a second mask in a region including the gate electrode with a droplet discharge method;

etching the semiconductor layer containing one conductivity type impurity and the semiconductor layer;

25 forming source and drain wirings with a droplet discharge method; and

etching the semiconductor layer containing one conductivity type impurity over the channel protective layer by using the source and drain wirings as masks.

30 12. A method for manufacturing a liquid crystal display device comprising the steps of:

forming a gate electrode and a connection wiring over a substrate having an insulating surface with a droplet discharge method;

laminating a gate insulating layer, a semiconductor layer, and an insulating layer over the gate electrode;

5 forming a first mask in a position overlapping with the gate electrode with a droplet discharge method;

forming a channel protective layer by etching the insulating layer by using the first mask;

forming a semiconductor layer containing one conductivity type impurity;

10 forming a second mask in a region including the gate electrode with a droplet discharge method;

etching the semiconductor layer containing one conductivity type impurity and the semiconductor layer;

15 partially exposing the connection wiring by selectively etching the gate insulating layer;

forming a source wiring and a drain wiring and connecting at least one of the source wiring and the drain wiring to the connection wiring at the same time; and

etching the semiconductor layer containing one conductivity type impurity over the channel protective layer by using the source and drain wirings as masks.

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13. The method for manufacturing a liquid crystal display device according to claim 11 or 12, wherein the step of laminating a gate insulating layer, a semiconductor layer, and an insulating layer over the gate electrode is carried out without exposing to the atmosphere.

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14. The method for manufacturing a liquid crystal display device according to claim 11 or 12, wherein the gate insulating film is sequentially laminated by a first silicon nitride film, a silicon oxide film, and a second silicon nitride film.

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